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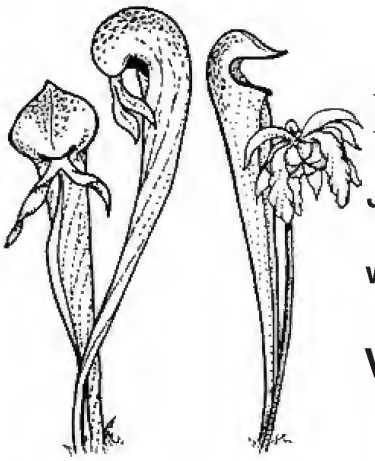

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Cover: View of *Anolis carolinensis* in the maw of *Dionaea muscipula*. Photo by Joel McNeal. Article on page 54.

Back cover: *Sarracenia* 'Opawa Emperor' pitcher lid. Photo by Mike Gilson. Article on page 56.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

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Letter from the Editor

After a long hiatus, we welcome back the savage gardener, Peter D'Amato, with his regular column in CPN. We can expect more of his fun-filled and insightful writing in upcoming issues. His first entry is on the "proper" use of SUPERthrive™ and he has a lot of fun with Barry and Beth's study showing the lack of an effect on the growth of *Nepenthes* when used in a manner many people have tried. I am sure glad they are all good friends!

Barry and Beth's article did what a good article should do, it started discussions. I know of at least one person that is going to try a test of SUPERthrive™ after one such discussion with Peter. I look forward to more exciting debate and articles from Peter and our readers!

Thank you,

Stephen Davis
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Correction: the photo shown in Figure 4 of the March 2009 CPN (Carniv.Pl.Newslett. 38: 15, 2009) should have been attributed exclusively to Michelle Meeks.

Soil Fertilization of *Sarracenia* Seedlings

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Keywords: cultivation: fertilizers, *Sarracenia*.

Conventional wisdom has it that soil fertilization is dangerous for carnivorous plants. A grower may get away with it once or twice with great results but the next time wipe out their whole collection. I have seen this on a small scale with volunteers at the University of California, Davis, Botanical Conservatory multiple times. At first the plants are truly stunning. Give them one treatment too many or at the wrong time and all the plants die. We are talking hundreds of plants.

Foliar fertilization with foliar fertilizer at a quarter to half of the label-recommended strength is what is generally recommended (D'Amato 1997, 1998a; Rice 2006), although Hanrahan (1986) recommends more dilute fertilizer used much more often. In fact, in general horticulture foliar fertilization is quite commonly recommended because plants are well adapted to absorbing nutrients on their leaves, especially carnivorous plants. But then there is the curious article by Peter D'Amato (D'Amato 1998b) about killing his Mexican *Pinguicula* while foliar fertilizing *Sarracenia* using a half-recommended-strength fertilizer solution in a watering can. Using a watering can results in more than foliar feeding! I mist Mexican *Pinguicula* with the same fertilizer at the same strength all the time with excellent results. This is starting to sound like soil fertilization.

What motivated me to do the experiments reported here was the success I had with heavy foliar feeding of the *Sarracenia rubra* subsp. *alabamensis* plants used for the ICPS distribution (Rice 2003). It was not exactly watering-can foliar feeding, but it was heavy enough to cause some algae and moss problems on the soil. *Sarracenia rubra* are notoriously slow growers and tend to stay small and clumpy for a long time. I had a deadline. The plants appeared to appreciate the fertilizer.

In trials I did in a terrarium at home I found that soil fertilization of *Dionaea* and *Sarracenia* seedlings was of little if any value. I think this is a result of the excessive moss growth, possibly reactions with the soil in stagnant terrarium conditions, and not enough light for the plants to effectively use the extra nutrients. But I was able to use much more fertilizer without killing any plants than I would have expected.

For the actual experiments I first wanted to do a trial determining the best level of fertilizer in a production system with the plants under the excellent greenhouse conditions available at UC Davis. I was growing a lot of *Sarracenia* for collections enhancement and new hybrid selections. I used a relatively low nitrogen fertilizer for this trial, thinking that nitrogen was not as important as phosphorus. A trial was then performed with different fertilizer formulations to see what the plants responded to best. I used a high-nitrogen fertilizer and a very high phosphorus fertilizer in addition to the balanced formulation.

Except for the high-phosphorus treatment, I used slow-release pellet ("prill") fertilizers. I wanted to avoid a system of periodic soil drenches as there are more likely to be errors and timing issues with that kind of a system. In addition, acidic soils generally pass nutrients directly through, so the plants would be alternating between high nutrients and low nutrients. The pellets should give a more uniform nutrient environment. It was not practical to add fertilizer to the water used for the carnivorous plants. That would probably be more common in a commercial growing situation where there are enough *Sarracenia* to justify a separate water system. The pellets have a plastic coating that should release the fertilizer slowly over a long period of time, keeping the nutrient levels constant. I felt that as long as the slow-release pellets were above the water level in the trays they would work as they were supposed to.

Materials and Methods

Three fertilizer trials were performed to test the effects of soil fertilization on the growth of seedling *Sarracenia*. The first trial tested the effect of the quantity of fertilizer used. The other trials tested the effect of using different fertilizer formulations. Each trial was initiated in the spring with one-year-old seedlings and lasted approximately 14 to 18 months. The plants were grown in a controlled-environment greenhouse at the University of California, Davis, along with other carnivorous plants being grown for collections enhancement, and received similar care that included occasional top watering and foliar feeding.

For all the trials, seedlings were transplanted into 56-mm wide by 85-mm tall "rose" pots. The pots had been filled with 1:1 peat:sand soil. Fertilizer pellets were placed about 1 cm below the surface of the soil. The pots were put into standard 27-cm by 54-cm wide, 6-cm deep plant trays with holes punched about 2 cm up the sides to keep the water level below the fertilizer pellets in the pots. The fertilizer pellets were individually selected so that a certain number of typical pellets were used per pot. The plants were then placed into a greenhouse with bright light year-round and heating and cooling. The trays were checked for water level daily and refilled with RO water as necessary. Occasionally the plants were top watered, the trays were dumped for cleaning, and the plants received foliar fertilizer.

Trial 1 consisted of 36 pots of *Sarracenia* seedlings. At the time we thought the seedlings were *S. oreophila* × *flava* var. *atropurpurea*—we wanted to use simple hybrid seedlings because of prior observations that simple hybrids generally had more uniform offspring than either complex hybrids or seed from cultivated pure species. However, we later learned that the *"S. flava"* parent was actually itself a plant of uncertain hybrid origin. Nine pots each had zero, 2, 4, or 6 pellets of Osmocote™ 14-14-14 Vegetable & Bedding formula 4-month-release fertilizer pellets. The maximum of 6 pellets was chosen as that is about the amount that would be used for non-carnivorous plants grown in that size pot. After 14 months, Conservatory propagation volunteers were asked to divide the plants into as many groups as they felt comfortable based on size and general health of the plant. The tags were turned so they could not be read during scoring. The volunteers opted to divide the plants into two groups: a score of "1" was given to the group with larger plants, "0" to the group with smaller plants. Minimum group size for scoring was five to conform to the requirements of statistical analysis by the χ^2 test.

Trial 2 consisted of 72 pots of a hybrid *Sarracenia flava* var. *rubricorpora* by the complex hybrid used in the cross for Trial 1. Eighteen pots each had no pellets, 4 Osmocote™ 14-14-14 Vegetable & Bedding formula 4-month-release fertilizer pellets, 4 Osmocote™ 17-7-12 commercial 12- to 14-month-release fertilizer pellets (this exact formulation is no longer available, but similar formulations are available in their Classic product line for commercial growers), or 4 double superphosphate 0-40-0 granules about the size of the Osmocote™ pellets (after it was too late it was discovered these were double superphosphate instead of regular superphosphate as intended). The author scored the plants at the end of the trial based on the same criteria as Trial 1. The plants were divided into four groups with higher scores given to the larger-sized plants.

Trial 3 consisted of 27 seedlings from a cultivated *Sarracenia leucophylla*, Wilkerson Bog, Walton Co., FL. Nine pots each had no pellets, 4 Osmocote™ 17-7-12 commercial 12- to 14-month-release fertilizer pellets, or 4 double superphosphate 0-40-0 granules. The author scored the plants at the end of the trial based on the same criteria as Trial 1. The plants were divided into three groups with higher scores given to the larger-sized plants.

Results

The first fertilizer trial testing the effects of the level of a balanced slow-release fertilizer showed that the use of the fertilizer in the soil was quite advantageous to the plants (see Table 1 and Figure 1). There were no fatalities. All treatments gave results that were statistically different using χ^2 tests ($p < 0.05$) and with larger plants than the "no fertilizer" control. The 4- and 6-pellet treat-

ments gave the same results, and those treatments were statistically different ($p < 0.05$) with larger plants than the 2-pellet treatment. The surprising result was not so much that the leaves were larger but that the rhizomes were huge for plants of that age (see Figure 2). Rhizome size was not measured, as to do so would have damaged the plants too much.

An interesting side note is that although the treated plants achieved apparent blooming size a year early, they did not produce inflorescences. This was also observed in plants not part of this trial. Additional experiments would have to be performed to confirm this was not simply a seasonal timing issue or a result of being under greenhouse conditions.

The results of Trials 2 and 3 indicated that nitrogen fertilizer level was a key element for the plants (see Tables 2 and 3 and Figure 3). There were two fatalities apparently unrelated to treatment, so they were ignored in the analysis. The double-superphosphate treatment plants in Trial 2 were statistically different using a χ^2 test ($p = 0.05$) and smaller than the controls; in Trial 3 they were not statistically different from the controls ($p = 0.64$). The slow-release fertilizer treatment plants were statistically different using χ^2 tests ($p < 0.05$) and larger than the controls and the double-superphosphate treatment plants. The higher nitrogen treatment was statistically different ($p = 0.0008$) from and the plants larger than the balanced formulation plants.

Discussion

These experiments indicate that under controlled greenhouse growing conditions *Sarracenia* seedlings benefit greatly from the use of soil fertilization with pelleted slow-release fertilizer. Although not used in these tests, the fertilizer I would use from now on for seedlings grown in a greenhouse or outdoors is Osmocote™ 19-6-12 4-month Outdoor & Indoor Smart Release® Plant Food. It is readily available, and in my tests putting the pellets into water and measuring conductivity with a TDS meter, it releases nutrients into the water more slowly than the 17-7-12 pellets used in the experiments reported here. The 17-7-12 pellets used were old, the plastic coating may have broken down somewhat, and the manufacturing process used when they were made may not be representative of any available now.

Soil fertilization could cause more problems than it is worth if the *Sarracenia* plants are not grown under enough light and in warm conditions. I hesitated publishing this paper because I was afraid I might encourage novice growers to over-fertilize their plants, killing or stunting them. Even at the UC Davis Botanical Conservatory where the experiments were conducted we do not routinely use these treatments for seedling *Sarracenia*—yet. We never experiment with all our plants. When we do experiment, we always use multiple plants for the control as well as for the experimental plants. If you do not have control plants to see what would have happened if you had done nothing different, you will not know what would have happened if you had done nothing. If you fertilize the one plant you have and it does spectacularly (or dies) all of a sudden, you do not know if it was the fertilizer or the cat. We are now checking to see if the treatments are safe for various pure species.

Availability of fertilizer to plant roots is very much dependent on soil conditions. Low pH soils like typical peat:sand mixes used by many growers have lower nutrient availability than soil mixes containing more neutral pH ingredients like coco coir. Substitution of chopped sphagnum moss or perlite or more or less sand could also affect availability. I would be wary of using these techniques with *Sarracenia* species that normally live on floating sphagnum mats such as *S. purpurea* subsp. *purpurea* and *S. minor* var. *okefenokeensis* since they would not normally experience the potentially high nutrients or salts in boggy soils. However, the other species probably experience relatively high nutrients, or at least salts, during periods of low precipitation in the wild and are thus somewhat pre-adapted to conditions they would experience with fertilizer as long as the water and soils used in the nursery are sufficiently low in other nutrients and salts.

It would require more experiments to determine the safe and effective levels of soil fertilization for juvenile and adult *Sarracenia*. I suspect that older plants of most species and hybrids would tolerate quite high levels of fertilizer. Because of their yearly growth cycles, in

Results of Trial 1		
Number of Pellets	Score	
	0	1
0[a]	9	0
2[b]	5	4
4[c]	1	8
6[c]	1	8

Table 1: Effects of different numbers of Osmocote™ 14-14-14 Vegetable & Bedding formula 4-month release fertilizer pellets per pot. For scoring, the plants were sorted into groups of similar size and health. The higher the score the larger and more healthy the plants in the group were judged to be. [a,b,c]Groups with same superscript are not significantly different ($p<0.05$).

Results of Trial 2				
Type of Pellets	Score			
	0	1	2	3
none[a]	6	12	0	0
0-40-0[b]	12	6	0	0
14-14-14[c]	0	6	9	3
17-7-12[d]	0	0	4	13

Table 2: Effects of Osmocote™ 14-14-14 Vegetable & Bedding formula 4 month release fertilizer pellets, Osmocote™ 17-7-12 commercial 12-14 month release fertilizer pellets, and double superphosphate 0-40-0 granules. For scoring, the plants were sorted into groups of similar size and health. The higher the score the larger and more healthy the plants in the group were judged to be. Groups with same superscript are not significantly different ($p<0.05$).

Results of Trial 3			
Type of Pellets	Score		
	0	1	2
none[a]	2	6	1
0-40-0[a]	2	4	2
17-7-12[b]	0	2	7

Table 3: Effects of Osmocote™ 17-7-12 commercial 12-14 month release fertilizer pellets and double superphosphate 0-40-0 granules. For scoring, the plants were sorted into groups of similar size and health. The higher the score the larger and more healthy the plants in the group were judged to be. [a,b]Groups with same superscript are not significantly different ($p<0.05$).

Figure 1:

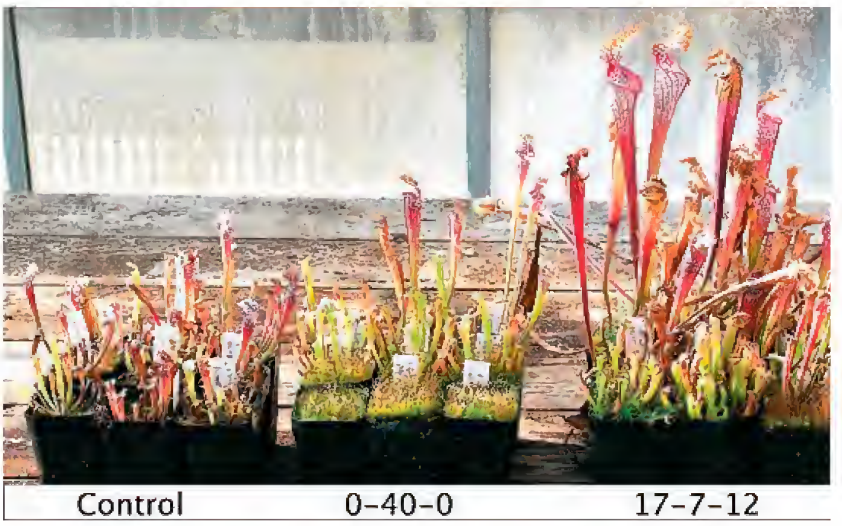
Plants from Trial 1 with different numbers of Osmocote™ 14-14-14 Vegetable & Bedding formula 4-month-release fertilizer pellets per pot.

Figure 2:

Comparison of plants from Trial 1 with a typical control plant on the bottom and a plant typical of those with 4 or 6 pellets on the top. Note the larger rhizome on the plant on the top. The name tag is erroneous, as described in the text.

Figure 3:

Plants from Trial 3 with 4 double superphosphate 0-40-0 granules and 4 Osmocote™ 17-7-12 commercial 12- to 14-month-release fertilizer pellets.



order for fertilization to be effective the timing would be critical and other growth conditions such as lighting should be optimal. The leaves may burn or become deformed at high levels, but if the purpose is to grow the plants as quickly as possible, that may be a small price to pay.

I have found the Osmocote™ pellets to be useful with other genera than *Sarracenia*. Large-scale commercial growers undoubtedly have fertilizer regimes that work well for them. For hobby growers the pellets are quite handy. I feed seedling *Nepenthes* and *Cephalotus* in their pitchers with dried blood worms. At about the point the plants can take a large pinch of blood worms I switch to Osmocote™ pellets. I only use one pellet in one pitcher in each plant and then wait to see what happens. The plants need to already be doing very well or the pitcher and possibly the plant could be killed. That usually means there is a lot of water in the pitchers. Be careful because over-fertilization of *Nepenthes* could cause them to grow too well and to stop producing pitchers. If your *Nepenthes* suddenly grow like crazy but don't produce pitchers, cut them back and use the excess growth for stem cuttings.

Acknowledgements: I thank Tim Metcalf, Ernesto Sandoval, Doug Walker, and interns and volunteers at the University of California, Davis, Botanical Conservatory for the space and assistance required to do these experiments.

References

D'Amato, P. 1997. The Savage Garden. Carniv. Pl. Newslett. 26: 64-66.
D'Amato, P. 1998a. The Savage Garden. Ten Speed Press, Berkeley.
D'Amato, P. 1998b. The Savage Garden. Carniv. Pl. Newslett. 27: 100-101.
Hanrahan, B. 1986. Simplistic CP fertilization facts. Carniv. Pl. Newslett. 15: 53.
Rice, B. 2003. *Sarracenia* distribution program. Carniv. Pl. Newslett. 32: 4-7.
Rice, B. 2006. Growing Carnivorous Plants. Timber Press, Portland.

An Informal Field Study of Some *Nepenthes* Habitats

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Keywords: ecology: Borneo, *Nepenthes* -- field studies: Borneo, *Nepenthes*.

Introduction

An informal field survey of *Nepenthes* habitats (see Figures 1 and 2) was accomplished during four separate trips to the areas around Mount Kinabalu (Sabah, Malaysia, in 2001, 2004, 2006, and 2007) and around the city of Kuching (Sarawak, Malaysia, in 2006). Measurements were made of soil pH and soil conductivity. Observations were made of soil characteristics, relative humidity, light levels, and other flora located with the *Nepenthes* plants.

General descriptions of *Nepenthes* habitats were available in the literature before the present work was undertaken (Cheers 1993; Kurata 1976; Phillipps & Lamb 1996; Pietropaolo & Pietropaolo 1986). More recently, more detailed information was published about *Nepenthes* ecology (Clarke 1997, 2001). Various habitats are described, such as kerangas forests, peat swamps, montane forests, etc. Soils are described as infertile, with composition that varies widely with location (e.g., sandy peat, ultramafic clay).

As a *Nepenthes* hobbyist who has struggled to grow the plants well, I desired more quantitative information about *Nepenthes* habitats so that I could apply this knowledge to the cultivation of these amazing plants. Though my first trip to Mount Kinabalu was in 1994 (Malouf 1995a, 1995b) the survey was begun during a trip to the Mount Kinabalu area in 2001 and still continues as the author's resources (and physical stamina) allow. So far, the survey includes only areas around Mount Kinabalu in Sabah, Malaysia, and around the city of Kuching in Sarawak, Malaysia.

I admit that I am not a botanist; my training is in the physical sciences. I am competent in taking measurements and reporting the data, but my views of how the data relate to cultivation are based on personal experience as a hobbyist. If this paper encourages the publishing of corroborating and/or opposing viewpoints, then so much the better for information exchange.

Data Collection and Measurement Methods

At each study location I recorded date and time, latitude and longitude, altitude, temperature, relative humidity, and light level near the plant(s). A general description of the area was noted (e.g., forest floor, open hillside, etc.), along with the kinds of plants growing with the *Nepenthes*. One *Nepenthes* plant was selected for more specific study, and photographs of the plant were taken (see Figure 3). A gentle excavation of part of the root system was done so that the course of the roots through the soil strata could be photographed, and then a small volume of the soil from around the roots was taken for later analysis (see Figure 4). The root system was then re-packed in the soil. (Inspection of studied *Nepenthes* plants in succeeding years showed no detrimental effects from this procedure.) The soil samples were packed into plastic camera film canisters. Samples from a day's excursion were carried in a backpack at ambient temperature and then analyzed at the end of the day for pH and conductivity.

Measurement of light level was done with a Model 401025 light meter from Extech Instruments (Waltham, MA), serial number L568338. The instrument was configured for a slow response of the display. Ambient measurement conditions were noted (e.g., blue sky, overcast, shaded by canopy, etc.). Measurement of relative humidity was done with a calibrated sling

psychrometer, model 12-7024 by Bacharach Corp. (Pittsburgh, PA). Ambient temperature was obtained from the dry bulb thermometer of the psychrometer. Latitude and longitude were obtained from a global positioning system receiver, the eTrex Vista from Garmin Corp. (Olathe, KS); altitude was obtained from the barometric altimeter of the Vista. The altimeter was re-calibrated periodically at locations of known altitude.

Measurement of soil pH and soil conductivity was done with a pH/conductivity meter from Extech Instruments, model number 341350, used with a pH electrode model 60120B and a conductivity electrode (model number not available). Calibration of the pH electrode was done according to supplied instructions. Calibration standards of pH 4 and pH 7 were prepared in precision volumetric flasks using distilled water and standard buffer chemicals obtained from Micro Essential Laboratory (Brooklyn, NY). Calibration of the conductivity electrode was done with standard solution C1058 (Lot 990524, Anachemia Co., Rouses Point, NY), conductivity 1000 μSiemens/cm. All glassware used in the pH and conductivity measurements was washed with soap and water and then thoroughly rinsed in distilled water before use.

For pH and conductivity measurements, a 35-cc sample of soil was mixed with distilled water in the ratio of one part soil to two parts water by volume. This dilution ratio was chosen because the volume of added water was the minimum necessary to produce a solution that could be conveniently analyzed. This ratio is one of the most widely used in soil testing (Stefferud 1957). The mixture was thoroughly stirred and then allowed to stand for at least two hours. Afterwards, the pH electrode was immersed in the mixture until the meter reading stabilized and then the pH reading was recorded precise to the first decimal place. The pH electrode was removed and then the conductivity electrode was immersed in the mixture. The conductivity reading of the sample was recorded in μSiemens/cm with a precision of 10 μSiemens/cm.

Discussion

Soil pH and Soil Conductivity

Table 1 contains a summary of the measurements of soil pH and soil conductivity, keyed to the plant where each soil sample was collected. Conductivity is given in μSiemens/cm.

The data confirm what has been stated in the referenced literature, that *Nepenthes* grow in soils that are acidic. (The case of *N. northiana* deserves further discussion and is presented in the next paragraph.) In some cases, the same species grows over a fairly wide range of soil pH, e.g.,

Species	pH	Conductivity	Species	pH	Conductivity
N. albomarginata	3.7	80	*N. northiana*	4.4-5.8	20-50
N. ampullaria	4.5-5.0	25-30	*N. rafflesiana*	4.4-4.5	20-30
N. bicalcarata	4.5	25-30	*N. rajah*	5.6-6.0	<10-40
N. burbidgeae	4.4-5.9	<10-20	*N. reinwardtiana*	4.2-6.6	<10-40
N. fusca	4.2-5.0	<10-70	*N. stenophylla*	4.8-6.0	<10-50
N. gracilis	3.8-5.6	<10-70	*N. tentaculata*	4.3-5.6	<10-10
N. hirsuta	3.6	70	*N. villosa*	5.4-5.6	<10
N. lowii	4.0-4.9	<10-20	*N.* x *alisaputrana*	4.7	20
N. mirabilis	4.2-5.0	<10-30	*N.* x *kinabaluensis*	5.1-5.3	<10

Table 1. pH and conductivity of soils near root zone of listed *Nepenthes*

N. reinwardtiana and *N. stenophylla*. The soils have a low conductivity, which suggests a low concentration of soluble ionic compounds (e.g., various salts). For comparison, my conductivity meter showed the conductivity of distilled water (no dissolved compounds whatsoever) to be 0-10 μSiemens/cm, the conductivity of rain water to be the same as distilled water, and the conductivity of my tap water at home to be about 300 μSiemens/cm. This last figure explains some of the trouble I had experienced in growing *Nepenthes*. The plants can suffer if their planting media accumulates dissolved salts introduced from the water.

Nepenthes northiana is known to grow on limestone hills, and limestone dissolved in water produces an alkaline solution (pH > 7). At first glance it seems that this species grows in an alkaline medium and thus is at odds with the rest of the genus. It is important, however, to determine where the roots of the plant are growing, and to test the characteristics of the material surrounding the roots rather than assume the roots are growing in the limestone substrate. The plant considered in this study was in a dense forest and had roots that were surrounded by loose humus. A sample of the humus was tested and displayed the characteristics shown in Table 1. In a more open and exposed area, plants were seen growing on the surface of limestone tufa that had a thin coating of moss. The plants were not accessible so it was not possible to extract a sample of this mixture from around the roots. In a more accessible area that had no *N. northiana*, some scrapings of material similar in appearance were removed from the limestone and tested. This material had a pH of 7.1 and a conductivity of 280 μSiemens/cm. It is not known for sure whether the tested material is the same as the material around the roots of the inaccessible *N. northiana* plants. It is certain, though, that the humus with the characteristics shown in Table 1 was collected from around the roots of a *N. northiana* plant.

In almost all of the observed habitats the underlying soil was covered with a layer of humus. In many cases, most of the *Nepenthes* roots were observed to grow into the humus layer while only a few tap roots entered into the underlying soil. The plants were found in soils with a wide range of compositions including underlying soils of ultramafic clay or sandy peat with humus on top, and soils of gravel covered with a thin mossy layer and no humus on top ("ultramafic" refers to minerals with high content of iron and magnesium).

Relative Humidity

The ideal study of relative humidity in *Nepenthes* habitats would have humidity meters in many different locations that would record the humidity constantly over the course of a year. Such an effort is beyond my capabilities. Instead I measured relative humidity just once at each of 48 locations where *Nepenthes* plants were found, in both mountain and lowland habitats. The measurements were made during the day between 9 a.m. and 5 p.m. Although this is not as thorough as the ideal study, it does indicate some clear trends. Table 2 summarizes the number of measurements falling within the indicated ranges of relative humidity.

RH (%)	100	90-99	80-89	70-79	60-69	50-59	40-49	30-39
# of Measurements	7	8	8	4	14	4	2	1

Table 2. Relative humidity measurements

Readings of 100% relative humidity occur in the presence of rain or drizzle. These readings can be neglected if we are interested in the relative humidity when it is not raining in the habitat. In that case, the data show a clear trend for relative humidity between 60% and 69%. The number of samples drops off sharply for lower values of relative humidity. There is another concentration of readings between 80% and 99%. This may be due to the fact that many of the studied habitats were in cloud forest areas (montane habitat) where fog was present, so these measurements might not apply to lowland habitats.

Light Level

Obviously, the amount of light available to a plant is a function of the surrounding vegetation

as well as weather conditions. I observed *Nepenthes* under a dense forest canopy where the light levels on a sunny day reached only 3230 lux. I have observed others on open hills where the light levels on a sunny day reached 53,580 lux. Some literature describes *Nepenthes* as not inhabiting dense forests but preferring forest edges where more light is available (Steiner 2002). I have observed similar situations, but this does not tell the entire story (see below).

Growth of *Nepenthes* and Companion Plants over Time

The measurements of soil pH and conductivity have already been presented as fairly constant for a given habitat, things that do not change with the time of day or season of the year. Relative humidity is also somewhat constant, in that it is almost always humid in a *Nepenthes* habitat. Light levels are not so constant over the life cycle of *Nepenthes*, being affected by how other plants grow alongside. The appearance of a *Nepenthes* habitat changes substantially over time as *Nepenthes* progress from seedlings to adult plants. *Nepenthes* are pioneer plants that are among the first to start growing in an area that has been disturbed somehow (e.g., landslide, forest fire, earth-moving equipment). After such a disturbance, the soil is bare and the area is often completely exposed to the sun. I have seen *Nepenthes* seedlings in such an environment. Nearby, adult plants of the same species were found in a habitat that included a lot of vegetation that had grown taller than the *Nepenthes* in many cases and was providing a lot of shade. When one observes mature *Nepenthes* plants in habitat, and tries to derive cultivation information from these observations, it is important to realize that the habitat may have been quite different when the *Nepenthes* first began to grow.

A good example of how the habitat changes as the *Nepenthes* mature is the kerangas forests around Kuching. These undergo periodic disturbances, such as fire, that leave an area bare and open. In places where vegetation begins growing again in the sandy peat, it is still mostly bare with a few shrubs about waist high and the occasional *Nepenthes* seedling. It is very open and sunny in these areas. Nearby, the undisturbed kerangas forest has tall trees, with large specimens of *N. rafflesiana* and *N. bicalcarata* climbing 4-5 m up the tree trunks. The shrubs found in the open areas are actually saplings of the same tall tree species found in the undisturbed areas (Ch'ien Lee, pers. comm.). This situation may explain why at least one author (Steiner 2002) describes adult plants preferring forest edges. In kerangas forest, the *Nepenthes* seedlings start side by side with the tree saplings and both grow up together. Once an area in the forest is cleared by fire, there are bound to be adult *Nepenthes* plants growing in the edges of the undisturbed forest around the cleared area.

For some of the slow-growing species, like *N. burbidgeae*, the habitat can change a lot as the *Nepenthes* mature. I have seen *N. burbidgeae* plants, whose stems under the dense forest canopy appeared to be small tree trunks as thick as my arm, climbing 9 m to the tree tops where the plants finally ended in a flourish of leaves and upper pitchers. I suspect that these mature plants are many decades old, so the surrounding plants had time to grow quite tall. Not far away, large basal rosettes could be found in more open areas. Seedlings were almost always in areas that were relatively clear except for some grasses.

Nepenthes gracilis grows much faster than *N. burbidgeae*, but the habitat progression is still similar. Adult *N. gracilis* plants were found near abandoned farming areas (abandoned probably because the soil was too poor to grow crops). The plants were 2 m tall in some cases and were growing through grass and shrubs of the same height. It is easy to imagine that the *N. gracilis* plants began to grow after the area had been cleared for farming. The seedlings would have been exposed to a lot of sun. Other grasses and shrubs grew alongside the seedlings so that the plants were intertwined when I finally observed them.

In soils that are more fertile, it is possible that the *Nepenthes* may begin growing but ultimately are crowded out by plants that can grow much faster in the better soil. I observed this on repeated trips to a location near Mount Kinabalu. During the first trip in 2004, a steep gravel hillside had many plants of *N. stenophylla, N. fusca,* and *N. reinwardtiana*. Some of them were large adult plants, others were seedlings of these plants and of their various hybrids. The rest of the hillside had some scattered clumps of grasses and moss on the otherwise bare gravel. In 2007 this same

hillside was covered with thick tall grass, so thick as to make it very difficult to walk into the growth. Not a single *Nepenthes* plant was observed there. The fact that there were adult plants on the hillside in 2004 suggests that the conditions were favorable for *Nepenthes* for several years, long enough for seedlings to grow to adulthood. Nevertheless, the conditions were also favorable enough for some grasses to completely overgrow the area and crowd out the *Nepenthes* by 2007. This site does not have public access, and a nearby hillside still had plenty of *Nepenthes* plants, so I doubt that the *Nepenthes* were poached.

Flora Found with *Nepenthes* in Habitat

Table 3 contains a listing of some plants found growing with *Nepenthes* in habitat, segregated according to altitude. For each altitude zone, the plants are further segregated into their various types. It is interesting that some plants are commonly found alongside *Nepenthes* across most of the altitude zones: *Gleichenia* sp., *Blechnum* sp., *Imperata cylindrica*, *Miscanthus* sp., and *Lycopodium* sp.

Altitude (m)	Plants
0-305	Trees and shrubs: *Cratoxylum arborescens, Ploiarium alternifolium, Dillenia suffruticosa, Dipterocarpus* sp., *Shorea* sp.; Orchids*: Arundina graminifolia, Bromheadia* sp., *Bulbophyllum* sp., *Paphiopedilum stoneii;* Ferns*: Gleichenia* sp.; Others*: Alocasia longiloba, Begonia* sp., *Lycopodium* sp.
305-610	Trees and shrubs: *Nauclea* sp., *Tristaniopsis* sp.; Ferns: *Blechnum* sp., *Gleichenia* sp.; Grass: *Imperata cylindrical;* Others: *Lycopodium* sp., *Melastoma* sp.
610-915	Trees and shrubs: *Adinandra* sp., *Gymnostoma* sp.; Ferns: *Gleichenia* sp.; Grass: *Miscanthus* sp.
915-1220	Trees and shrubs: *Ficus* sp., *Macaranga* sp.; Grass: *Imperata cylindrica, Miscanthus* sp.; Ferns: *Pteridium* sp.; Others: *Melastoma* sp.
1220-1525	*Trees and shrubs: Crotalaria* sp., *Gymnostoma* sp., *Macaranga* sp., *Nauclea* sp., *Vaccinium* sp.; *Grass: Miscanthus* sp.; *Orchids: Arundina graminifolia; Ferns: Blechnum* sp., *Pteridium* sp.; *Others: Lycopodium* sp., *Melastoma* sp.
1525-1830	Trees and shrubs: *Adinandra* sp., *Nauclea* sp., *Phyllocladus* sp.; Orchids: *Arundina graminifolia, Coelogyne* sp., *Spathoglottis* sp.; Ferns: *Gleichenia* sp.; Grass: *Miscanthus* sp.; Others: *Lycopodium* sp., *Melastoma* sp.
1830-2135	Trees and shrubs*: Agathis* sp., *Dacrydium* sp., *Leptospermum* sp., *Phyllocladus* sp., *Vaccinium* sp.; Orchids: *Coelogyne* sp.; Ferns: *Blechnum* sp., *Gleichenia* sp.; Grass: *Juncus* sp., *Miscanthus* sp.; Others: *Hedyotis* sp., *Lycopodium* sp., *Melastoma* sp.
2135-3050	Trees and shrubs: *Dacrydium* sp., *Leptospermum* sp., *Phyllocladus* sp., *Styphelia* sp., *Vaccinium* sp.; Orchids: *Coelogyne* sp., *Trichotosia* sp.; Others: *Hedyotis* sp., *Iridaceae* sp.

Table 3. Listing of flora found with *Nepenthes*

Field Observations Applied to Cultivation

In applying the above observations to the cultivation of *Nepenthes*, I follow the common-sense rule that the plants will thrive in cultivation if they are given what they enjoy in their native habitat.

The composition of the soil is not as important as the pH and conductivity of the mix. No matter what potting media used, it is important for the pH to be acidic, and for the conductivity to be as low as possible. It is also important to provide water that is free from dissolved salts and other chemicals or else a potting medium that starts out with low conductivity could accumulate salts and the soil conductivity will rise. A plant that has been repotted in a proper soil and is growing vigorously will begin to suffer after several months as the conductivity of the soil increases, which makes salt accumulation a very

Figure 1: *Nepenthes fusca* with seed pods.

Figure 2: *Nepenthes rajah* and *Nepenthes tentaculata* in the wild.

Figure 3: *Nepenthes mirabilis* pitchers.

Figure 4: The partially excavated root system of *Nepenthes mirabilis*. Blue pen for scale comparison.

sneaky problem. Some growers are lucky enough to have plenty of available rain water, or other sources of very pure water. Most urban areas have treated water that is not very good for *Nepenthes* over time. (Remember, *Nepenthes* in habitat get rain water.) One final note about potting media—if in doubt about your mix, have the pH and conductivity tested. One grower told me he used coconut husk successfully until he changed suppliers. The new supplier rinsed the coconut husk in sea water! Needless to say, *Nepenthes* plants did not grow well at all in this salty coconut husk.

Nepenthes enjoy a constant relative humidity between 60% and 70%. Sometimes the humidity does drop to 45% in habitat but it does not stay there for long. Relative humidity in a greenhouse is linked to temperature, decreasing with increasing temperature and vice versa. Temperature is typically highest during the day and coolest at night, so humidity tends to be highest at night and lowest in the day. Some means of humidity replenishment during the heat of the day is a good idea for cultivating *Nepenthes*. The best temperature for the plants will depend on whether the natural habitat is on the cool side (e.g., upper montane areas, cloud forests) or very hot (e.g., lowland kerangas forests).

Light for cultivating *Nepenthes* is a complicated subject, especially if artificial lighting is considered, and the topic deserves a separate article. Since *Nepenthes* in their habitat get sunlight, it stands to reason that artificial lighting should be as close as possible to the solar spectrum. In contrast to this, fluorescent lights have been used with some success even though they have a spectrum that is quite different from the solar spectrum. As for light level, this varies widely in the field even for the same species. The only general trend is that seedlings are often found in open areas that are exposed to strong light on clear sunny days. Sometimes adult plants are found in these conditions. More often, though, adult plants are found growing among other plants that provide shade (and sometimes this shade is substantial).

Plants that are given what they enjoy in habitat should thrive in cultivation. If the soil conductivity or soil pH is a bit high, or the humidity is a bit low and inconsistent, then the plants may survive but they will neither thrive nor look their best.

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References

Cheers, G. 1992. A Guide to Carnivorous Plants of the World. Harper Collins Publishers, Pymble NSW 1993, Australia, pp. 141-142.

Clarke, C. 1997. *Nepenthes* of Borneo. Natural History Publications (Borneo) Sdn. Bhd., Kota Kinabalu, Sabah, Malaysia. pp. 23-32.

Clarke, C. 2001. *Nepenthes* of Sumatra and Peninsular Malaysia. Natural History Publications (Borneo) Sdn. Bhd., Kota Kinabalu, Sabah, Malaysia. pp. 29-40.

Kurata, S. 1976. *Nepenthes* of Mount Kinabalu, Sabah National Parks Trustees, Kota Kinabalu, Sabah, Malaysia. pp. 21-24.

Malouf, P. 1995a. A visit to Kinabalu Park. Carniv. Pl. Newslett. 24: 64-69.

Malouf, P. 1995b. A visit to Kinabalu Park. Carniv. Pl. Newslett. 24: 104-108.

Phillipps, A., and Lamb, A. 1996. Pitcher-Plants of Borneo. Natural History Publications (Borneo) Sdn. Bhd., Kota Kinabalu, Sabah, Malaysia. pp. 43-45.

Pietropaolo, J., and Pietropaolo, P. 1986. Carnivorous Plants of the World. Timber Press, Portland, Oregon. p. 40.

Stefferud, A. (ed.) 1957. The Yearbook of Agriculture. USDA, Washington, DC. p. 188.

Steiner, H. 2002. Borneo Its Mountains and Lowlands with their Pitcher Plants. Toihaan Publishing Company Sdn. Bhd., Kota Kinabalu, Sabah, Malaysia. p. 31.

The Folklore of Man-Eating Plants

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Keywords: history: legends.

Stories and tales of man-eaters seep from every continent on earth. They instantly conjure up feelings of fascination, adventure, and terror. Too frequently these events are over-sensationalized and told with a journalistic (shall we say "attention-grabbing") slant. The stories usually portray the accused man-eater as some horrible beast, and the men being eaten as innocent, helpless victims. This is mostly far from the truth; most occurrences of predation on people are caused or instigated by the people who are attacked. In fact most animals labeled with the unfortunate moniker of man-eater are quite innocent of that accusation. But, what if this accused man-eater is a plant!

There are over 660 known species and subspecies of carnivorous plants (Rice 2007). Needless to say, none are known man-eaters. Common knowledge dictates that the main diet of carnivorous plants (at least the species so far discovered) is insects. So should carnivorous plants really be called insectivorous plants? Over time, observations by scientists have proven otherwise. There are cases of carnivorous plants capturing and devouring frogs, lizards, and even small mammals such as mice or small rats. (There are also mentions of birds becoming prey, but I cannot find any specific observations of that.) Most carnivorous plant growers certainly know their plants can digest small chunks of meat placed within the traps. But it gets more interesting because there are anecdotes that support the idea that some species of carnivorous plants are "moving up the ranks," so to speak. In his 1998 book The Savage Garden, Peter D'Amato recounts a story told to him by a "well-to-do" couple who recently returned from a botanical garden in Malaysia where they witnessed massive pitcher plants hanging from trees. While peering through a fence waiting for the exhibit to open, they observed an attendant pulling baby monkeys out of the giant pitchers. While they stated most scampered off unharmed, some monkeys appeared not so lucky and were put into a pail. The husband continues on to say that they caught up with the attendant and questioned him about what he was doing, and the attendant stated that the dead monkeys in the pitcher plants needed removal because they were upsetting to the tourists. D'Amato suspects the couple misidentified the species of mammal being pulled from the traps; his opinion is that the unfortunate victims to be of the mice family, not the simian, but he could not document or follow up on the story. The natural world has such wonders that it might be entirely plausible for very small monkeys to succumb to such a plant. But plants claimed to consume prey the size of a man certainly might invoke a different attitude.

The western world first got wind of stories describing plants or trees of the man-eating variety when an article was published in 1878; it recited a letter written by German traveler Carle Liche who was exploring Madagascar. In this letter Liche wrote of a man-eating tree and a primitive tribe of pygmy people called the Mkodos. The story, summed up, describes the tribe of Mkodos ritually sacrificing a girl to the tree (Mackal 1980). Liche describes the appearance of the man-eating plant as a:

> "pineapple eight feet high and thick in proportion resting upon its base and denuded of leaves". He goes on to say the trunk "was not the color of an [b]anana, but a dark dingy brown, and apparently as hard as iron. From the apex of this truncated cone (at least two feet in diameter) eight leaves hung sheer to the ground, like doors swung back on their hinges. These leaves that were joined at the top of the tree at regular intervals were about eleven or twelve feet long, and shaped very much like the leaves of the American agave or century plant. They were two feet through at their thickest point and three feet wide, tapering to a sharp point that looked like a cow's horn, very convex on the outer (but

now under) surface, and on the under (now upper) surface slightly concave. This concave face was thickly set with strong thorny hooks like those on the head of the teazle. These leaves hanging thus limp and lifeless, dead green in color, had in appearance the massive strength of oak fibre. The apex of the cone was a round white concave figure like a smaller plate set within a larger one. This was not a flower but a receptacle, and there exuded into it a clear treacly liquid, honey sweet, and possessed of violent intoxicating and soporific properties. From underneath the rim (so to speak) of the undermost plate a series of long hairy green tendrils stretched out in every direction towards the horizon. These were seven or eight feet long, and tapered from four inches to a half inch in diameter, yet they stretched out stiffly as iron rods. Above these (from between the upper and under cup) six white almost transparent palpi reared themselves toward the sky, twirling and twisting with a marvelous incessant motion, yet constantly reaching upwards. Thin as reeds and frail as quills, apparently they were yet five or six feet tall, and were so constantly and vigorously in motion, with such a subtle, sinuous, silent throbbing against the air, that they made me shudder in spite of myself, with their suggestion of serpents flayed, yet dancing upon their tails."

Later this story and its details were investigated by many including Dr. Roy Mackal and Willy Ley. Neither Ley nor Mackal, who investigated this matter independently and years apart, found any evidence to support the story. They could not even find any support of a tribe of people comparable to the primitive pygmy Mkodos living in Madagascar, or even the existence of a German traveler by the name of Carle Liche (Mackal 1980). Mackal, a zoologist at the University of Chicago, also made note of the improbability that a plant could sustain so much frantic and constant palpi motion as described in Liche's story. But, the man-eating tree of Madagascar story does not end with Liche.

A world explorer named Chase Salmon Osborn, LL.D., who also served as the governor of Michigan from 1911 to 1913, heard of the horrible tree residing in Madagascar and went there to try his luck at finding the tree. Upon his return he authored a book of his adventure aptly named Madagascar, Land of the Man-Eating Tree (see http://www.madagascar-library.com/r/1090.html), published in 1924. Osborne never did see the fabled tree. But during his exploration of the island he did hear stories and myths about it from all the native people he encountered of many different tribes. He even questioned local missionaries about the existence of the tree; most were skeptical of the tree, but not all (Mackal 1980). Even though Osborn returned empty-handed, he still believed there was something to this mystery and was impressed by the information he recovered during his travels. In defense of his opinion of the possible existence of a man-eating tree he pointed out that Madagascar has been known as "The Land of the Man-Eating Tree" since its discovery and that most of this island at the time remained largely unexplored. He admitted that the only thing improbable about the tree was its size, which he observed, "is not always a safe measuring standard of values". He also describes a similar unknown plant, but of a smaller size, which he saw in London (Michell & Rickard 2000). He writes, "At the London Horticultural Hall in England there is a plant that eats large insects and mice. Its principal prey are the latter. The mouse is attracted to it by a pungent odor that emanates from the blossom which encloses a perfect hole just big enough for the mouse to crawl into. After the mouse is in the trap bristle-like antennae enfold it. Its struggles appear to render the Gorgonish things more active. Soon the mouse is dead. Then digestive fluids much like those of animal stomachs exude and the mouse is macerated, liquefied and appropriated. This extraordinary carnivorous plant is a native of tropical India. It has not been classified as belonging to any known botanical species." This no doubt is the closest we have come to an unknown and fantastic plant that sounds like it could easily be a new species. It does not seem to be unlike the genus *Nepenthes* and yet has some original, more active trapping methods and seems to prey regularly on larger prey, such as mice.

Shortly after the publication of Liche's report, botanists tried to close the book on the possibility of the man-eating tree of Madagascar. But at least one prominent botanist seemed to consider its existence; when Francis Ernest Lloyd noted in his book The Carnivorous Plants (1942), after

talking of his list of all known species of carnivorous plants and other plants thought to be carnivorous but were later proven not to be, he notes "The 'man-eating tree of Madagascar' must at present also be excluded, since the evidence of its existence is elusive". But today it would seem safe to say the Man-eating tree of Madagascar must stay in the realm of folklore, and for now, not be seen in the index of Madagascar's botanical field guides (though one can hope for further searches to change this!).

But evidence for large-vertebrate-eating trees does not end there…

In Buel's 1887 book Land and Sea, he talked of an account given to him by a "gentleman of his acquaintance, who, for a long time, resided in Central America" describing a tree named a Ya-te-veo ("I can see you") which is said to grow in areas in Central and South America with similar species residing in Africa and on the shores of the Indian Ocean (in: Michell & Rickard 2000):

> Travelers have told us of a plant, which they assert grows in Central Africa and also in South America, that is not contented with the myriad of larger insects which it catches and consumes, but its voracity extends to making even humans its prey. This marvelous vegetable Minotaur is represented as having a short, thick trunk, from the top of which radiate giant spines, narrow and flexible, but of extraordinary tenaciousness, the edges of which are armed with barbs, or dagger-like teeth. Instead of growing upright, or at an inclined angle from the trunk, these spines lay their outer ends upon the ground, and so gracefully are they distributed that the trunk resembles an easy couch with green drapery around it. The unfortunate traveler, ignorant of the monstrous creation which lies in the way, and curious to examine the strange plant, or to rest himself upon its inviting stalk approaches with out a suspicion of his certain doom. The moment his feet are set within the circle of the horrid spines, they rise up, like gigantic serpents, and entwine themselves about him until he is drawn upon the stump, when they speedily drive their daggers into his body and thus complete the massacre. The body is crushed until every drop of blood is squeezed out of it and becomes absorbed by the gore-loving plant, when the dry carcass is thrown out and the horrid trap set again.

Later, a Dr. Andrew Wilson wrote a column titled "Science Jottings" in an August 27, 1892, issue of Illustrated London News, in which he wrote of a naturalist by the name of Mr. Dunstan who was "botanizing" in one of the many swamps surrounding Nicaragua Lake. While hunting for specimens he suddenly heard his dog cry out in pain. Running towards the animal's cry, "Mr. Dunstan found him enveloped in a perfect network of what seemed to be a fine, ropelike tissue of roots and fibres. The plant or vine seemed composed entirely of bare-interlacing stems, resembling more than anything else the branches of a weeping willow denuded of its foliage, but of a dark, nearly black hue, and covered with a thick, viscid gum that exuded from the pores." (Mackal 1980). Dunstan eventually, and with great effort, cut the dog free. He stated the dog's skin "appeared to be actually sucked or puckered in spots" and reported the skin on his hand while freeing his dog got "red and blistered" from the plant grabbing him. Finally, he told that the tree is well known to the natives, and they tell many tales of its "death-dealing powers." In a following article contained in a September 24, 1892, issue, Dr. Wilson wrote:

> The 'snake-tree' is described in a newspaper paragraph as found on an outlying spur of the Sierra Madre, in Mexico. It has movable branches (by which I suppose, is meant sensitive branches), of a 'slimy, snaky appearance,' which seized a bird that incautiously alighted on them, the bird being drawn down till the traveler lost sight of it. Where did the bird go to? Latterly it fell to the ground, flattened out, the earth being covered with bones and feathers, the debris, no doubt, of former captures. The adventurous traveler touched one of the branches of the tree. It closed upon his hand with such force as to tear the skin when he wrenched it away. He then fed the tree with chickens, and the tree absorbed their blood by the means of the suckers (like those of the octopus) with which its branches were covered.

Those two accounts sound eerily familiar to one another even though the prey differed in size. But there is more to come of a plant of this description.

In an August 1934 edition of Wide World Magazine, a French explorer, Baron Byron Khun de Prorok, recounted some memories of his journeys leading a party of explorers into the impenetrable jungle regions of Chiapas in southern Mexico (Shuker 2003). One of these memories he recounts thusly:

> After two hours' march we breathed with difficulty, and were bathed in perspiration. Suddenly I saw Domingo, the leader of the guides, standing before an enormous plant and making gestures for me to go to him. I wondered what could be the matter. I soon saw; the plant had just captured a bird! The poor creature had alighted on one of the leaves, which had promptly closed, its thorns penetrating the body of the little victim, which endeavored vainly to escape, screaming meanwhile in agony and terror. "Plante vampire!" explained Domingo, a cruel smile spreading over his face. Involuntarily I shuddered; the forest was casting its evil spell upon me.

Shuker points out that De Prorok was a renowned explorer, that the last three accounts of unknown carnivorous plants above are remarkably similar in morphology, and that if in fact the stories are true, they are possibly of the same species. The discrepancies, which are so minute, certainly can be explained by error in reporting. Shuker's opinion is that De Prorok's description is probably the most accurate. He defends this position, saying it would be much more simple to accept the existence of a plant that has sensitive thorn-bearing leaves, similar to a trapping mechanism already in use by the Venus Flytrap, than a plant evolving botanical sucker-like devices that are capable of actively draining a bird of its blood.

There is also one last report coming from South America, specifically Brazil. It involves a report from Randall Schwartz's 1974 book, Carnivorous Plants. He claims that in a "recent report" by a Brazilian explorer venturing through the rainforest searching for a settlement of Yatapu Indians, he found a tree capable of consuming animals. He said it released a distinctive scent that attracted monkeys, urging them to come towards and climb the tree's trunk. While climbing the trunk of the tree the leaves would suddenly wrap around them, rendering them helpless and proceeding to digest them (Shuker 2003). This monkey-eating behavior might remind you of the account told to D'Amato by the "well to do" couple, with one difference being this Brazilian account deals with an apparently unknown species of carnivorous plant, given away by its different trapping mechanism. It is interesting to note the genus *Nepenthes* has been referred to by the nickname "monkey cups" by some, due to some reports of monkeys occasionally drinking water from the plant's pitchers. The previous reports of the monkeys becoming prey certainly give a deadly spin on that epithet.

Lastly, there are many recent reports coming from India of a cow-eating tree. As recently as October 23, 2007, a report came from the village of Padrame bordering the Uppinangady range forest (Anonymous 2007). Residents spotted a carnivorous tree trying to capture a cow. Reports state the cow was left to graze in the forest by the owner, Anand Gowda, when the cow was suddenly grabbed by the tree's branches and "pulled from the ground." A terrified cowherd witnessing this ran to the village and got Gowda and a group of villagers to hurry to the tree. The news report then states:

> Before the tree could have its meal, Anand Gowda and the villagers struck mortal blows to the branches that turned limp and the cow was rescued. Uppinangady range forest officer (RFO) Subramanya Rao said the tree was described as 'pili mara' (tiger tree) in native lingo. He had received many complaints about cattle returning home in the evenings without tails. On Friday, the field staff confirmed coming across a similar tree in Padrane, partially felled down. However no detailed inquiry was made as the authorities were not asked for any report, Rao said.

The possibility of a cow-eating tree does seem less than promising considering a cow's size. But maybe there is some tiny grain of truth hidden behind the villager's folklore and superstition. Maybe the cow-eating tree's description and legend is based on a smaller, yet similar plant that devours small animals and gives rise to ideas that a plant could consume bovines.

To conclude this article, it must be said that a plant or a tree would certainly not evolve to prey strictly on man. (If so we would probably be aware of it before now.) Based on these stories

you could speculate that possibly somewhere in the dark, unexplored rainforests there could be a plant that has the ability to prey on animals the size of man, and if given the opportunity would devour a human being. Yet all these stories could also be explained away as tales and yarns. But maybe one day, we will find out that prehistorically man-eating plants did exist, and the reports received today could be explained by vestiges in our memory of the day when man had reason to fear plants that possessed these gruesome abilities.

References

Anonymous. 2007. Cow-eating trees of Padrame. http://www.newindpress.com/NewsItems.asp?ID=IEK20071023040252&Page=K&Headline='Cow-eating'+trees+of+Padrame&Title=Southern+News+-+Karnataka&Topic=0. Accessed 23 October 2007.

D'Amato, P. 1998. The Savage Garden. Ten Speed Press, Berkeley, California.

Lloyd, F.E. 1942. The Carnivorous Plants. Chronica Botanica, New York, New York.

Mackal, R. 1980. Searching for Hidden Animals: An Inquiry into Zoological Mysteries. Doubleday, New York, New York.

Michell, J., and Rickard, B. 2000. Unexplained Phenomena. Penguin Group, London.

Osborn, C.S. 1924. Madagascar, Land of the Man-Eating Tree. New York Republic Publishing Company, New York.

Rice, B. 2007. Carnivorous plant FAQ v11.5, http://www.sarracenia.com/faq.html. Accessed March 2008.

Schwartz, R. 1974. Carnivorous Plants. Praeger Publishers, New York.

Shuker, K. 2003. The Beasts that Hide from Man. Paraview Press, New York, New York.

Board Member Election

The ICPS Board has a vacancy. All members of the ICPS are encouraged to run for a board position in the ICPS. If you would like to participate in the workings of the ICPS, please email a 250-word election statement to Richard Myers, richard@carnivorousplants.org. Your election statements must be received by 1 August 2009. In your statement, you may wish to note your experience, why you want to run for office, and what you wish to accomplish. Your statements will be printed in the September issue.

The ICPS is a growing, active organization. In order to participate as a board member, email access is essential. Furthermore, board members are expected to work hard! So while we welcome and encourage your interest as a board member, remember that it is more than a vanity post! Consider running for office—your energy is appreciated and needed!

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The Venusian Lizard Trap

Joel McNeal • Athens • Georgia • USA • j.mcneal@yahoo.com

Keywords: Carnivory: *Dionaea*, prey.

I have grown carnivorous plants for a few years now, but really ramped up my collection since moving to Athens, Georgia, last year.

Last summer I had a *Dionaea muscipula* plant sitting out on my deck where it made a good living catching two to three flies per day on average without my help. It grew very well, and at its peak it had well over twenty large traps on long sturdy stalks. It is not any special cultivar; it is just a normal plant. But it has a huge appetite!

One day I went out and found a young cockroach (they are ubiquitous outdoors here) about 2.5 cm (one inch) long caught inside a trap. In my experience, cockroaches are awful carnivore food, and the trap was already rotting off. It smelled like a dead animal 10 times the size. As I was snipping off the rotten trap to get rid of the foul stench, I noticed another trap with what appeared to be a worm hanging out. Then I noticed two legs hanging off the "worm." It was actually a small green anole! This little *Anolis carolinensis* had apparently jumped from my deck railing, over the moat my flytrap pot was in, and landed in a most unfortunate spot! You might suspect that this could have been the result of a forced feeding by sadistic neighborhood children, but my deck, where the plant is grown, is inaccessible except from my second story room. The flytrap is not even visible from the ground level, so this happened completely naturally. By the time I found it, the anole was already dead. I was surprised it could not escape, but it looks to be in a rather awkward position. I hoped to see how well the trap would do with digesting such a strange prey, but the next morning both the lizard and 3/4 of the trap were missing. I suspect the Carolina Wrens or Northern Mockingbirds that frequent my deck found the free meal.

Definitely, a strange and unlikely occurrence!

This, and the front cover, show *Anolis carolinensis* in the maw of *Dionaea muscipula.*

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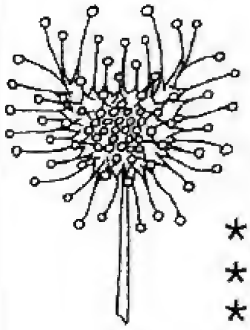

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New Cultivars

Sarracenia 'Kilimanjaro'

Submitted: 5 December 2008

Sarracenia 'Kilimanjaro' (see Figures 1 and 2) is the result of my crossing a pretty *Sarracenia (psittacina* x *rubra)* x *leucophylla* hybrid with one of my strongest *S. leucophylla* plants. This is a strong-growing cultivar with erect leaves reaching 61 cm (24 in). Since it is three-quarters *S. leucophylla*, it is similar to that species in form and general aspect with the same white markings. It is distinguished by being about 25 percent shorter, by having a hood that is relatively wider and flatter, and, most of all, by having a more compact and profuse branching structure, which, combined with exceptional vigor, results in a profusion of leaves and flowers. The flowers are red, within the range of *S. leucophylla*. As one would expect with this parentage, this cultivar reaches its vegetative peak in late summer and fall. At the end of the growing season, leaves are often strongly blotched with pink.

Sarracenia 'Kilimanjaro' originated from seed that I sowed in December 1997. The plant was named by me in September 2005. To me, it seems both lush and rugged, green below and white above, like the mountain for which it is named.

To maintain these desirable characteristics, this plant should be reproduced only by vegetative means.

— Jerry Addington • Courting Frogs Nursery • 32601 76th Ave. NW • Stanwood, WA 98292 • USA • jerry@courtingfrogs.com

Sarracenia 'Tapestry'

Submitted: 5 December 2008

Sarracenia 'Tapestry' (see Figure 3) is one of several outstanding seedlings from a cross I made in May 1996 between a *Sarracenia oreophila* x *purpurea* hybrid with a large ruffled hood and one of my first *Sarracenia leucophylla* plants.

The young leaves of *Sarracenia* 'Tapestry' are green. The oversized ruffled hood and upper pitcher tube are liberally patterned with red veins and white areoles. The pitcher throat, lip and pronounced lip-spout are dark red with a red line extending from the spout down the entire length of the tube. As leaves age, reds become deeper and the deep red throat and lip become red-black. The flowers are a dusky red-pink. The summer leaves reach 46-56 cm (18-22 in) in height. Winter leaves are green with a red line down the flat inner side of each leaf and grow to 15-20 cm (6-8 in) high. As the plants multiply, they make a nicely compact clump; one of the plant's ornamental traits.

As I observed this plant over several years, it occurred to me that it was like an abstract tapestry, woven with luxurious color and intricate pattern. In September 1998, I named it 'Tapestry'.

To keep the special qualities of this plant, reproduction should be done by vegetative methods.

— Karen Oudean • Oudean's Willow Creek Nursery • 7421 137th Ave. SE • Snohomish, WA 98290 • USA • KarenOudean@comcast.net

Sarracenia 'Opawa Emperor'

Submitted: 07 August 2008

Sarracenia 'Opawa Emperor' is a superb form of *Sarracenia flava* var. *cuprea* with promi-

nent red veining and an elegant pitcher shape (see Figure 4). This particular plant has been in my collection for over 20 years where it dominates the collection due to its sheer size and unique characteristics.

The plant was obtained as one of three *S. flava* seedlings from the sales table at a meeting of the New Zealand Carnivorous Plant Society in Christchurch, New Zealand, in 1984. As the seedlings matured, all were found to be different and I labelled them as Flava Type 1, 2 and 3. Type 3, when fully mature and grown under good light conditions, exhibited the characteristics of the special *S. flava* form that I have called the 'Opawa Emperor'.

The mature plant has pitchers of 80-90 cm (31-35 in) in height with an almost perfectly round mouth of up to 90 mm (3.5 in) from lip to lip. New pitchers have a distinct copper blush to the top of the lids which extends, under good light conditions, to the top of the pitcher (see Back Cover). Sharply defined red veining is prominent on the top and inside the lid which also extends down the pitcher. The apiculate tip of the lid extends vertically and straight for 8-10 mm (0.3-0.4 in). Another characteristic is the prominent red vein which runs around the top of the lip. The ala has a red outer edge which extends the full length of the pitcher. The throat has the prominent red splotch typical of *S. flava* var. *flava* and *S. flava* var. *rugelii*; the splotch is surface pigmentation as it does not extend though to the outside. The top of the pitcher is highly flared with a very large rolled lip which is pale yellow in colour. The pitcher is a paler green than *S. flava* var. *maxima*. In late summer, the lid loses its copper coloration and becomes butter yellow between the venation.

Another interesting feature of this plant is that it is the first of all of my *Sarracenia* to flower; at least a week in advance of others. The flowers are typical *S. flava* size and colour, and are extremely odorous. The sepals have similar coloration to the petals and have faint red veining. The petals are slightly spear-shape and remain flat until they drop. The plant readily sets seed although I have never attempted to raise it from seed so cannot say whether self-pollinated seed breeds true. I have always propagated by rhizome division. To maintain these desirable characteristics, this plant should be reproduced only by vegetative means.

The plant is very vigorous and produces pitchers continuously through spring and summer;

Figure 1: *Sarracenia* 'Kilimanjaro' mature pitchers. Photo by Jerry Addington.

Figure 2: *Sarracenia* 'Kilimanjaro' young pitchers. Photo by Jerry Addington.

Figure 3: *Sarracenia* 'Tapestry' pitchers. Photo by Karen Oudean.

in late summer phyllodia appear. The spring pitchers tend to be the largest.

Collectors of *Sarracenia* in New Zealand are a relatively small group and most *Sarracenia* species can usually be traced to importation prior to CITES. There is no record of this plant in the 1983 and 1988 plant survey lists of the New Zealand Carnivorous Plant Society and I can only assume that the true origin of this plant is unknown. My research shows there are no other plants of this form in New Zealand collections other than a small number supplied by me. This is a spectacular plant and is the first plant that visitors to my collection notice due to its "wow" factor and virtually perfect form. Whilst I have many other varieties of *S. flava* in my collection this one stands head and shoulders over them; when seen en masse it is a truly magnificent sight.

I have named this plant the 'Opawa Emperor' as Opawa is the area of Christchurch where I live and Emperor due to its regal and majestic stature.

— Mike Gilson • Christchurch • New Zealand • mmvgilson@paradise.net.nz

Figure 4: *Sarracenia* 'Opawa Emperor' pitchers. Photo by Mike Gilson.

Max Schaefer (maxs@hotmail.com) writes: I have been using MaxSea 15-15-15 fertilizer on my *Nepenthes* for over two years now. I use the mix at the strength indicated on the bottle and I water the plants normally with the fertilizer solution. I do this once a month on over 100 *Nepenthes* ranging from seedlings to mature flowering plants. The difference in the growth rate of my plants has been dramatic. Contrary to my fears, the results have not been large leaves and small or fewer pitchers — I am getting larger, nicer pitchers as well. My conditions could be described as highland-intermediate. The most dramatic beneficial effect of fertilization has been on the lowland plants that had been struggling in my care. They exploded with growth and I was even able to flower a huge *N.* "Viking" despite overnight temperatures into the low fifties! There are pitfalls to fertilizing, however. I have found that the long-fibered sphagnum (lfs) in my mixes broke down fairly rapidly, so I have moved to using lfs-free mixes. After eight years of growing, I am still learning about the best growing methods for *Nepenthes*, but my experiences and the advice from growers much more advanced than I have convinced me to make fertilizing a permanent part of my *Nepenthes* growing regimen.

Damon Collingsworth of California Carnivores (calcarn@aol.com) writes: We recently have switched fertilizers here at California Carnivores. I had personally been using MaxSea All Purpose Fertilizer 16-16-16 on all of my veggies for years now, but hadn't gotten around to trying it on my carnivorous plants. After a couple of our customers had mentioned casually that they were using it on their *Nepenthes* with great success, I decided to give it a try. I tested it on my personal collection first. I dissolved one teaspoon of MaxSea into a 5-liter sprinkle can and sprinkled it over the leaves and into the tops of the pots of all of my carnivorous plants. There were no ill effects on any of the plants. We have since started fertilizing all of our plants at California Carnivores with this concentration every two weeks with no ill effects. We've tried it on *Sarracenia*, *Dionaea*, *Drosera*, *Drosophyllum*, *Nepenthes*, *Pinguicula*, and *Utricularia*. All are growing well and we are watching carefully for long-term results or problems. We have, however, been very pleased with it so far and are now carrying it here at California Carnivores for $15.95 for 1.5 lbs of concentrate. More long-term results to come soon.

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News from the Field

Brian Barnes • ICPS Conservation Director • brian@carnivorousplants.org

Hello Friends!

Well, it looks like the year is already flying by, and most of us in the northern hemisphere are in the peak of our growing seasons. I hope everyone's collections are prospering. We have some very exciting things going on conservationally with the ICPS this year. Conservation is beginning to enter a whole different level upwards.

As many of you are well aware, the Splinter Hill research project is in full swing, and the *Sarracenia* and everything else are waking up nicely. I'm going there this year to film and document all of the progress. I'll have some wonderful updates, video, and photos to share with everyone, so that those who kindly gave can see their hard-earned dollars at work, along with the rest of our cherished members. I truly can't say "thank you" enough for the kind assistance and generosity of our outstanding ICPS members. None of this would be made possible without our beloved membership of fellow CP enthusiasts.

Other great news is that The Nature Conservancy has recently informed us that the new highway project that was threatening the Green Swamp in Brunswick County, North Carolina, will not be taking place, due to the economic recession and lack of highway funding. Though thwarted at present, we'll have to watch and make sure this threat doesn't rear its head again in more prosperous economic times. The Green Swamp is home to 14 different species of carnivorous plants and is one of the finest examples of pristine pineland savannah in the United States. I'll be following this very closely as well, reporting any information I find.

The Florida Panhandle has been in peril as well lately. Due to the poor economy and the resulting super-cheap land prices, lots of construction activity is commencing in areas containing vast amounts of *Sarracenia*, with some clumps being over .5 m (1.5 ft) in diameter, and a host of other CP as well. I've been coordinating a possible CP rescue through enthusiasts residing in that immediate area. I'll also be researching and following all proposed construction and road projects within the Panhandle area before they begin. All threatened areas will be grid-mapped via GPS, photographed, and filmed as well. Then, rescue efforts will be planned prior to the destruction of such areas, which are homes to our beloved CP. I'll be keeping everyone updated on those successes as well. A special thanks goes out to CP enthusiast and photographer Bill Boothe in Bristol, Florida, for his outstanding efforts, constant communications, and watchful eye.

If anyone wishes to donate to any of the the above-mentioned projects, this can be done on our ICPS homepage at www.carnivorousplants.org.

Well, that's about all I have for now. I'll keep everyone updated on all of the above. Happy growing to all.

Controlling invading overgrowth with prescribed fire. Photo by Keith Tassin, TNC.

A "field of dreams" of *Sarracenia leucophylla*. Photo by Ashley Morris.

The Savage Garden: Barry and Beth's Misguided Adventures with SUPERthrive™

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Keywords: cultivation: Superthrive

My good friends Barry Rice and Beth Salvia wrote of their experiments with "mysterious, smelly" SUPERthrive™ in their article "Looking for horticultural effects of SUPERthrive™ on *Nepenthes*" in the March 2009 issue of CPN.

Yet the types of experiments they performed could be compared to someone wishing to test the benefits of toothpaste by applying the paste to their armpits. I was going to mention another body part, but it was rather distasteful.

Without naming names, the authors report hearing "anecdotal stories" about the uses of SUPERthrive™ (hereafter Superthrive) from "It saved my *Nepenthes rafflesiana* from death!" to "one 'capful' of Superthrive per liter of purified water is commonly cited." Well, I don't doubt these unnamed sources; however, it might have helped if Barry and Beth — and their sources — had simply read the directions on the bottle! In fact, on Barry's engrossing website, www.sarracenia.com, he solicited comments on the uses of Superthrive. Not one respondent mentioned a foliar application. They apparently read the label and nearly all had favorable results.

It is probably I who first introduced the use of Superthrive to the general carnivorous plant-growing public. I did so in my award-winning, bestselling book The Savage Garden (D'Amato 1998), currently in its eighth printing. Rather than have you pull the book from your shelves, bear with me while I quote from page 23:

> Vitamin B-1 is a supplement for plants commonly available in nurseries, and found in the popular American brand Superthrive, which adds other vitamins and ingredients to its solution. These are not fertilizers as commonly supposed, and their use is often controversial among carnivorous plant enthusiasts. Some growers greatly applaud their use, while others find their benefits dubious. Personally, I have found products such as Superthrive quite good for carnivorous plants when one follows the manufacturer's instructions. Vitamin B-1 has long been used as a root-growth-promoting ingredient, primarily for general garden and houseplants. It is most often used when transplanting bare-rooted plants, and helps them overcome shock by encouraging root growth. Bare-rooted plants are usually soaked in a solution of ten drops per gallon of water for half an hour or so before they are put into soil. For general plant care, manufacturers of products such as Superthrive recommend a one-drop-per-gallon application with each regular watering. I have noticed that bare-root soaking of carnivorous plants in Superthrive or vitamin B-1 during the process of transplanting them can reduce losses due to shock. It is particularly helpful when moving tissue-cultured CPs from flask into soil. In my experience, losses due to shock were reduced considerably, if all other conditions were good. Keep in mind that a general application of such products in high doses will increase the growth of algae even more dramatically than is caused by the application of fertilizers. I would therefore not recommend high doses applied directly to soil.

I also refer to the product under the propagation section of the chapter The Sundews. From page 166:

> One method I have used to enhance leaf cuttings is to dip them in a solution of Superthrive (one drop per cup of water) before laying them out.

Barry and Beth did three experiments in their article. In the first one, they took cuttings of *Nepenthes*, put them in sphagnum moss (with no reported use of rooting hormones), and using one capful of Superthrive per liter of water (ye gods!), sprayed the cuttings "until all plant surfaces were fully wetted."

In the second experiment they soaked fresh cuttings in a diluted concentration of Superthrive.

In the third experiment on established, rooted, potted plants they again applied a foliar spray once a week using two drops per gallon of water.

Well, considering what they did in their experiments and then comparing it to what the manufacturer of Superthrive recommends in their directions, no wonder Barry and Beth concluded that they "were unable to detect any beneficial effects from SUPERthrive™." Duhhhh!

Superthrive is not a fertilizer. It is not a rooting hormone. The primary ingredients (which the authors never even mention in their article) are Vitamin B-1 (.09%) and naphthylacetic acid (.048%). Vitamin B-1 (VB1) is thiamine hydrochloride, which is normally produced in the leaves of plants and then sent down to the roots and promotes root growth. Naphthylacetic acid is a hormone known to enhance root growth and is often found in various fertilizers. The hyperbole of "50 vitamins-hormones" found in Superthrive's advertising I don't doubt since the company used to produce liquid human vitamins until pills became all the rage. But the above-mentioned ingredients are the only two actually listed on the label.

I have found that using the product the way I recommend in The Savage Garden yields the same results as using horticultural VB1 in reducing transplant shock of ROOTED plants and in greatly increasing plantlet growth of sundew leaf cuttings, or for that matter, flytrap and butterwort leaf cuttings as well. I did these personal, undocumented experiments in the 1980s.

One thing Barry and Beth didn't mention is that if they really sprayed the cuttings with the extremely high dosage of Superthrive reported in the experiments, they must have soon seen an abundance of "green." That would have been from algae and slime mold which would have rapidly grown on the sphagnum mosses their cuttings were rooted in.

Here's an experiment for you: In a gallon of purified water, add about a teaspoon of algae-ridden water and a teaspoon of Superthrive or VB1. As a control, do the same with a second gallon, omitting the Superthrive or VB1. Place both gallons in the sun for several days and let me know what happens. Think St. Patrick's Day.

Here's another experiment. Take two fresh, healthy sundew leaves, dipping one into a cup of water containing one to three drops of Superthrive or VB1. Do nothing to the second leaf. Lay both leaves out on milled sphagnum or peat moss as you would for typical leaf-cutting propagation. Let us know what happens.

I have used and sold Superthrive at my nursery California Carnivores for twenty years. I almost never use it mixed with fertilizers (one drop per gallon) as the manufacturer recommends, although this might enhance a plant's absorption of minerals. We mostly foliarly feed our CP anyway, so not getting into the roots, the Superthrive would do nothing — as Barry and Beth amply proved!

Incidentally, the Vitamin Institute, which manufactures Superthrive, has offered a $5,000 award to anyone who can disprove their suggested beneficial uses of "the stuff," as they call it. It has remained unclaimed for 69 years! I guess those who did try to get the award became....converted! Invasion of the Body Snatchers! How do you think they propagated so many of those Pods? And the duplicates who emerged from the Pods were all wearing Superthrive T-shirts! (Offered free to retailers of "the stuff.")

Seriously, the seemingly outrageous claims on Superthrive's packaging and website (www.superthrive.com) do seem a bit over the top. However, it was this sort of advertising that won its inventor, John A. Thompson, a lifetime achievement award in marketing. It has generally eliminated from nursery shelves most VB1 competition. I met the elderly Mr. Thompson at a horticultural trade show some years back, and he is quite a character! Not unlike the labels of his bottles!

Barry and Beth should have concluded their article by claiming their foliar application of Superthrive, which showed no beneficial results, was only Phase One. More experiments are needed. Stay tuned!

References

D'Amato, P. 1998. The Savage Garden. Ten Speed Press, Berkeley, California. 314 p.

Rice, B.A., and Salvia, E.M. 2009. Looking for horticultural effects of SUPERthrive™ on *Nepenthes*. Carniv. Pl. Newslett. 38: 24-27.

Literature Reviews

By Doug Darnowski

Ziaratna, S.M, Kunert, K.J., and Lall, N. 2009. Elicitation of 7-methyljuglone in *Drosera capensis.* South African Journal of Botany 75: 97-103.

Many members of ICPS will be aware that carnivorous plants have been the source of various medicines over time. *Drosera* is no exception, with several homeopathic remedies based on it. While the efficacy of these is highly doubtful, *Drosera* has been shown to be a source of various anti-microbial compounds which fall under the general heading of quinines. The authors of this paper report on the production of 7-methyljuglone in tissue-cultured plants, with the best conditions involving mixed nitrogen supplementation and the application of salicylic acid, which is associated with plants' responses to attack by pathogens. (DWD)

Peroutka, M., Adlassnig, W., Volgger, M., Lendl, T., Url, W.T., and Lichtscheidel, I.K. 2008. *Utricularia*: a vegetarian carnivorous plant? Plant Ecology 199: 153-162.

Anyone who has looked at more than one or two *Utricularia* bladders under the microscope knows that the traps of aquatic species are often full of various green algae. It has been suggested that this may be the plants using their translucent traps as tiny aquaria to enhance their nutrient uptake. In this paper, the authors, well-known for their wide-ranging work on carnivorous plants, show that most of the algal cells in the traps of several species of bladderworts from Europe are indeed digested, and they leave the question open as to whether this provides the plant with a benefit, making these vegetarian carnivorous plants, or a further stress, carnivorous plants usually growing in stressful habitats. (DWD)

Thornhill, A.H., Harper, I.S., and Hallam, N.D. 2008. The development of the digestive glands and enzymes in the pitchers of three *Nepenthes* species: *N. alata, N. tobaica,* and *N. ventricosa* (Nepenthaceae). International Journal of the Plant Sciences 169: 615-624.

An enduring controversy in the biology of *Nepenthes* is whether the unopened pitchers make fully functional digestive enzymes, only pro-enzymes (enzymes needing slight modification before they can act), or none at all. Generally, opinions these days lie in either of the first two groups. In this paper the authors make a nice combination of biochemistry and microscopy as they study the fine structural development of the digestive glands in the three species of *Nepenthes*, demonstrating the production even in unopened (i.e., immature) pitchers of fully functional digestive enzymes. (DWD)